



21 September 1994

Dr. Spiro Lekoudis
Acting Division Director
Mechanics Division
Office of Naval Research
800 North Quincy Street
Arlington, Virginia 22217

19951026 082

Dear Dr. Lekoudis:

**FINAL REPORT
AND
END-OF-THE-FISCAL-YEAR LETTER FOR FY-94**

**OFFICE OF NAVAL RESEARCH GRANT N00014-91-J-1203
UNSTEADY VISCOUS PROPULSOR HYDRODYNAMICS**

a. Description of the scientific research goals

1) Computational studies to explicate the fundamental physical mechanisms of unsteady viscous propulsor hydrodynamics: development of methods for obtaining time-accurate Navier-Stokes and Reynolds-averaged Navier-Stokes solutions for flows involving fixed and moving boundaries and separation; determination of appropriate time and length scales for such flows; and investigations of the interaction between natural and forced unsteady flows.

b. Significant results in the past year

1) Completion/Publication of parametric study for the MIT FFX to document the effects of frequency, waveform, and foil geometry in conjunction with ONR Grant N00014-92-J-1118.

2) Completion/Publication of study of interaction of natural and forced unsteady flows (i.e., harmonic forcing of the naturally unsteady wake of a flat plate at incidence using an oscillating body-force field and trailing-edge flap), including use of overlaid grids for resolution of fixed (hull) and moving (propulsor) boundary problems in conjunction with ONR Grant N00014-92-J-1118.

3) Completion/Publication of unsteady-flow results for P4119 and P4132 for idealized temporal and spatial in flows in conjunction with ONR Grant N00014-92-J-1118.

c. Plans for next year's research

1) Extensions and related work will continue under other ONR grants.

d. ONR Data Base Information (via enclosure 1)

DTIC QUALITY INSPECTED 4

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IN REPLY
REFER TO

DTIC-OCC

SUBJECT: Distribution Statements on Technical Documents

TO: OFFICE OF NAVAL RESEARCH
CORPORATE PROGRAMS DIVISION
ONR 353
800 NORTH QUINCY STREET
ARLINGTON, VA 22217-5660

1. Reference: DoD Directive 5230.24, Distribution Statements on Technical Documents, 18 Mar 87.

2. The Defense Technical Information Center received the enclosed report (referenced below) which is not marked in accordance with the above reference.

FINAL REPORT
N00014-91-J-1203
TITLE: UNSTEADY VISCOUS
PROPULSOR HYDRODYNAMICS

3. We request the appropriate distribution statement be assigned and the report returned to DTIC within 5 working days.

4. Approved distribution statements are listed on the reverse of this letter. If you have any questions regarding these statements, call DTIC's Cataloging Branch, (703) 274-6837.

FOR THE ADMINISTRATOR:

1 Encl

GOPALAKRISHNAN NAIR
Chief, Cataloging Branch

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WITH DOD DIRECTIVE 5230.25, WITHHOLDING OF UNCLASSIFIED TECHNICAL DATA FROM PUBLIC
DISCLOSURE, 6 Nov 1984 (Indicate date of determination). CONTROLLING DOD OFFICE IS (Indicate
Controlling DoD Office).

The cited documents have been reviewed by competent authority and the following distribution statement is
hereby authorized.

A

(Statement)

OFFICE OF NAVAL RESEARCH
CORPORATE PROGRAMS DIVISION
ONR 353
800 NORTH QUINCY STREET
ARLINGTON, VA 22217-5660

(Controlling DoD Office Name)

(Reason)

Debra T. Hughes
(Signature & Typed Name)

DEBRA T. HUGHES
DEPUTY DIRECTOR
CORPORATE PROGRAMS OFFICE

(Assigning Office)

(Controlling DoD Office Address,
City, State, Zip)

19 SEP 1995

(Date Statement Assigned)

- e. **Interactions/Technology Transfer** (via enclosure 2)
- f. **List of Publications/Reports/Presentations/Patents/Graduates**
(via enclosure 3)
- g. **List of Honors/Awards** (via enclosure 4)
- h. **Other Sponsored Research** (via enclosure 5)
- i. **Estimated funding balance as of 30 Sept 1994** (via enclosure 6)

Submitted by,

F. Stern
F. Stern
Principal Investigator

encl.

cc: Mr. R. Silverman, ONR, Seattle

Accession For	
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OFFICE OF NAVAL RESEARCH
PUBLICATIONS/PATENTS/PRESENTATIONS/HONORS REPORT
01 October 1993 through 30 September 1994

N00014-91-J-1203

R&T Number:

Contract/Grant Title: Unsteady Viscous Propusor Hydrodynamics

Program Officer: E. Rood

Principal Investigator: Fred Stern

Mailing Address: Iowa Institute of Hydraulic Research, The University of Iowa, Iowa City, IA 52242

Phone Number: 319 335-5215

FAX Number: 319 335-5238

E-Mail Address: frstern@icaen.uiowa.edu

- | | |
|---|------------|
| a. Number of Papers Submitted to Referred Journal but not yet published: | _____ |
| b. Number of Papers Published in Referred Journals: (List Attached): | _____ |
| c. Number of Books or Chapters Submitted but not yet Published: | _____ |
| d. Number of Books or Chapters Published (List Attached): | _____ |
| e. Number of Printed Technical Reports & Non-Referred Papers (List Attached): | 1
____ |
| f. Number of Patents Filed: | _____ |
| g. Number of Patents Granted (List Attached): | _____ |
| h. Number of Invited Presentations at Workshops or Professional Society Meeting (List Attached): | _____ |
| i. Number of Presentations at Workshops or Professional Society Meetings (List Attached): | _____ |
| j. Honors/Awards/Prizes for Contract/Grant Employees: (List Attached, may include Society Awards/Offices, Promotions, Faculty Awards/Offices, etc.) | 1
_____ |

k. Providing the following information will assist with statistical purposes.

PI/CO-PI: TOTAL 1
Female _____
Minority* _____

Grad Students:** TOTAL 1
Female _____
Minority* _____

Post Doc:** TOTAL 1
Female _____
Minority* _____

1. Degrees Granted (List Attached):

1

* Underrepresented or minority groups include Blacks, Hispanics, and Native Americans.
Asians are not considered an underrepresented or minority group in science and engineering.

** Supported at least 25% this year on contract/grant.

Enclosure (1)

TECHNOLOGY TRANSFER

Technology transfer is an important measure of the relevance of scientific endeavors. ONR Program Officers need to be aware of any such transfer, and they will use it to the benefit of their programs. Please describe any recent (approximately last three years) direct or indirect interactions you had with Navy, other DoD, or industrial scientists and engineers; describe only those interactions that resulted in their use of methodology, data, software, or other developments produced or directly derived from your ONR grant/contract. Also describe similar technology transfer, if any, that resulted without any such interactions.

Enclosure (2)

LIST OF PUBLICATIONS/REPORTS/PATENTS/GRADUATES *

1. Papers Published in Referred Journals:

2. Books (and sections thereof) Published:

3. Technical Report, Non-Refereed Papers:

Chen, B., Stern, F., and Kim, W.J., "Computation of Unsteady Viscous Marine Propulsor Blade and Wake Flow," Proc. 20th ONR Symposium on Naval Hydro., Santa Barbara, CA, August 1994.

4. Presentations:

5. Patents Granted:

6. Degrees Granted (name, date, degree):

Paterson, E.G., "Computation of Natural and Forced Unsteady Viscous Flow with Application to Marine Propulsors," Ph.D. Thesis, Department of Mechanical Engineering, The University of Iowa, May 1994.

* List only those funded directly from you ONR grant/contract. Use additional pages, if necessary.

Enclosure (3)

OTHER SPONSORED RESEARCH

(Include title, sponsors's name, dollar amount
and start and end dates for the award)

F. Stern	Free-Surface Effects on Ship Boundary Layers and Wakes ONR Grant No. N00014-92-J-1092 October 1987-September 1991, \$150K/year
F. Stern	Viscous Propulsor Hydrodynamics ONR Grant N00014-92-J-1118 October 1991-September 1994, \$100K/year
F. Stern	Evaluation of Surface-Ship Boundary-Layer and Wake and Wave Field Model Scale Data Base ONR/SNAME Grant N00014-93-1-0052 October 1992-September 1994, \$15K/year
F. Stern	Near-Field Ship Hydrodynamics AASERT Award N00014-93-1-1103 October 1993-September 1995, \$229,592.

Enclosure (5)

FUNDING BALANCE

A major issue at ONR is expenditure rates. Not meeting Navy required expenditure rates will result in redirection of resources within ONR for FY95 that starts on 01 October 1994! I would like to enlist your help in preventing this from occurring. If your expenditure rate is below that required by your contractual arrangement with ONR, we will be forced to delay funding increments in your contract/grant, even if the delay is due to slow billing from your business office. If the problem is at your business office, please take action to correct it.

Indicate the remaining ONR grant/contract resources you have in your institution as of 30 SEP 94:

\$ 282.

Enclosure (6)